



State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
Coal Regulatory Program Directive

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Tech-004

Effective Date:
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Supersedes:
Water Monitoring Programs
for Coal Mines Directive
Dated May 6, 1996

Subject: **Water Monitoring Programs for Coal Mines**

Approved: _____ On: _____
James W. Carter, Director, Division of Oil, Gas, and Mining

DISCLAIMER

“This non-binding directive is intended for internal direction for the Utah Coal Regulatory Program to clarify the implementation of the Utah Coal Rules. It neither confers rights nor imposes obligations on the Division or any other party. In the case where a conflict is perceived to exist between this directive and the Utah Coal Rules, the rules prevail.”

ABSTRACT

The Utah Coal Regulatory Program requires all mines to develop water monitoring programs to assess the hydrology of the permit and adjacent areas. These monitoring programs should be sufficient to determine the Probable Hydrologic Consequences of all coal mining and reclamation activity upon the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas. This directive provides guidance to achieve the goals and objectives of a successful surface and ground water monitoring program. By defining terms, stating objectives, and identifying responsibilities, it is meant to clarify the Division's position on what constitutes an appropriate monitoring program and provides methodology for consistently amending these monitoring programs.

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1. Purpose

The purpose of this directive is to clarify the Division's position on water monitoring program requirements so as to facilitate permitting, compliance and decision making processes for Utah coal mines.

Water monitoring requirements are established to identify and assess the hydrologic conditions prior to, during and after mining to ensure protection of the hydrologic balance, and to detect changes to the hydrologic regime caused by mining activities.

It is the Division's intent to work with mining operations to ensure that the monitoring plan provides complete environmental information for analyses, yet minimize the burden and costs of excessive sampling.

2. Regulatory Basis

R645 et. seq. Coal Mining Rules and as referenced:
R645-301-130, R645-301-330, R645-301-723, R645-301-724, R645-301-725, R645-301-725, R645-301-728, R645-301-731, R645-301-751

R645-301-723. Sampling and Analysis. All water quality analyses performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Water quality sampling performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to either methodology listed above when feasible. "Standard Methods for the Examination of Water and Wastewater" is a joint publication of the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and is available from the

American Public Health Association, 1015 Fifteenth Street, NW, Washington, D. C. 20036.

R645-301-724 Baseline Information. The application will include the following baseline hydrologic, geologic and climatologic information, and any additional information required by the Division.

724.100. Ground Water Information. The location and ownership for the permit and adjacent areas of existing wells, springs and other ground-water resources, seasonal quality and quantity of ground water, and usage. Water quality descriptions will include, at a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron and total manganese. Ground-water quantity descriptions will include, at a minimum, approximate rates of discharge or usage and depth to the water in the coal seam, and each water-bearing stratum above and potentially impacted stratum below the coal seam.

724.200. Surface Water Information. The name, location, ownership and description of all surface-water bodies such as streams, lakes and impoundments, the location of any discharge into any surface-water body in the proposed permit and adjacent areas, and information on surface-water quality and quantity sufficient to demonstrate seasonal variation and water usage. Water quality descriptions will include, at a minimum, baseline information on total suspended solids, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron and total manganese. Baseline acidity and alkalinity information will be provided if there is a potential for acid drainage from the proposed mining operation. Water quantity descriptions will include, at a minimum, baseline information on seasonal flow rates.

724.500. Supplemental Information. If the determination of the PHC required by R645-301-728 indicates that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or that acid-forming or toxic-forming material is present that may result in the contamination of ground-water or surface-water supplies, then information supplemental to that required under R645-301-724.100 and R645-301-724.200 will be provided to evaluate such probable hydrologic consequences and to plan remedial and

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reclamation activities. Such supplemental information may be based upon drilling, aquifer tests, hydrogeologic analysis of the water-bearing strata, flood flows, or analysis of other water quality or quantity characteristics.

R645-301-725. Baseline Cumulative Impact Area Information.

725.100. Hydrologic and geologic information for the cumulative impact area necessary to assess the probable cumulative hydrologic impacts of the proposed coal mining and reclamation operation and all anticipated coal mining and reclamation operations on surface- and ground-water systems as required by R645-301-729 will be provided to the Division if available from appropriate federal or state agencies.

725.200. If this information is not available from such agencies, then the applicant may gather and submit this information to the Division as part of the permit application.

725.300. The permit will not be approved until the necessary hydrologic and geologic information is available to the Division.

R645-301-728. Probable Hydrologic Consequences Determination.

728.100. The permit application will contain a determination of the PHC of the proposed coal mining and reclamation operation upon the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas.

728.200. The PHC determination will be based on baseline hydrologic, geologic and other information collected for the permit application and may include data statistically representative of the site.

728.300. The PHC determination will include findings on:

728.310. Whether adverse impacts may occur to the hydrologic balance;

728.320. Whether acid-forming or toxic-

forming materials are present that could result in the contamination of surface- or ground-water supplies;

728.330. What impact the proposed coal mining and reclamation operation will have on:

728.331. Sediment yield from the disturbed area;

728.332. Acidity, total suspended and dissolved solids and other important water quality parameters of local impact;

728.333. Flooding or streamflow alteration;

728.334. Ground-water and surface-water availability; and

728.335. Other characteristics as required by the Division; and

728.340. Whether the proposed SURFACE COAL MINING AND RECLAMATION ACTIVITY will proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose.

728.400. An application for a permit revision will be reviewed by the Division to determine whether a new or updated PHC determination will be required.

731.200. Water Monitoring.

731.210. Ground-Water Monitoring. Ground-water monitoring will be conducted according to the plan approved under R645-301-731.200 and the following:

731.211. The permit application will include a ground-water monitoring plan based upon the PHC determination required under R645-301-728 and the analysis of all baseline hydrologic, geologic and other information in the permit application. The plan will provide for the monitoring of parameters that relate to the suitability of the ground water for current and

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approved postmining land uses and to the objectives for protection of the hydrologic balance set forth in R645-301-731. It will identify the quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance. At a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron, total manganese and water levels will be monitored;

731.212. Ground-water will be monitored and data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any ground-water sample indicates noncompliance with the permit conditions, then the operator will promptly notify the Division and immediately take the actions provided for in R645-300-145 and R645-301-731;

731.213. If an applicant can demonstrate by the use of the PHC determination and other available information that a particular water-bearing stratum in the proposed permit and adjacent areas is not one which serves as an aquifer which significantly ensures the hydrologic balance within the cumulative impact area, then monitoring of that stratum may be waived by the Division;

731.214. Ground-water monitoring will proceed through mining and continue during reclamation until bond release. Consistent with the procedures of R645-303-220 through R645-303-228, the Division may modify the monitoring requirements including the parameters covered and the sampling frequency if the operator demonstrates, using the monitoring data obtained under R645-301-731.214 that:

731.214.1. The coal mining and reclamation operation has minimized disturbance to the prevailing hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses and the SURFACE COAL MINING AND RECLAMATION ACTIVITY has protected or replaced the water rights of other users; or

731.214.2. Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.211.

731.215. Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of ground water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

731.220. Surface-Water Monitoring. Surface-water monitoring will be conducted according to the plan approved under R645-301-731.220 and the following:

731.221. The permit application will include a surface-water monitoring plan based upon the PHC determination required under R645-301-728 and the analysis of all baseline hydrologic, geologic and other information in the permit application. The plan will provide for the monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance as set forth in R645-301-731 as well as the effluent limitations found in R645-301-751;

731.222. The plan will identify the surface water quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance:

731.222.1. At all monitoring locations in streams, lakes and impoundments, that are potentially impacted or into which water will be discharged and at upstream monitoring locations, the total dissolved solids or specific conductance corrected to 25 degrees C, total suspended solids, pH, total iron, total manganese and flow will be monitored; and

731.222.2. For point-source discharges, monitoring will be conducted in accordance with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for National Pollutant Discharge Elimination System (NPDES) permits;

731.223. Surface-water monitoring data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any surface water sample indicates noncompliance with the permit conditions, the operator will promptly notify the Division and immediately take the actions provided for in R645-300-145 and R645-301-731. The reporting requirements of this paragraph do not exempt the operator from meeting any National Pollutant Discharge Elimination System (NPDES) reporting requirements;

731.224. Surface-water monitoring will proceed through mining and continue during reclamation until bond release. Consistent with R645-303-220 through R645-303-228, the Division may modify the monitoring requirements, except those required by the Utah Division of Environmental Health, including the parameters covered and sampling frequency if the operator demonstrates, using the monitoring data obtained under R645-301-731.224 that:

731.224.1. The operator has minimized disturbance to the hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses and the SURFACE COAL MINING AND RECLAMATION ACTIVITY has protected or replaced the water rights of other users; or

731.224.2. Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.221.

731.225. Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of surface water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

R645-301-751. Water Quality Standards and Effluent Limitations. Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all

Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

3. Definitions

"Adjacent Area" means the area outside the permit area where a resource or resources, determined according to the context in which adjacent area is used, are or reasonably could be expected to be adversely impacted by proposed coal mining and reclamation operations, including probable impacts from underground workings.

"Affected Area" means any land or water surface area which is used to facilitate, or is physically altered by, coal mining and reclamation operations. The affected area includes the disturbed area; any area upon which coal mining and reclamation operations are conducted; any adjacent lands the use of which is incidental to coal mining and reclamation operations; all areas covered by new or existing roads used to gain access to, or for hauling coal to or from coal mining and reclamation operations; any area covered by surface excavations, workings, impoundments, dams, ventilation shafts, entryways, refuse banks, dumps, stockpiles, overburden piles, spoil banks, culm banks, tailings, holes or depressions, repair areas, storage areas, shipping areas; any areas upon which are sited structures, facilities, or other property material on the surface resulting from, or incident to, coal mining and reclamation operations; and the area located above underground workings.

"Coal Mining and Reclamation Operations" means (a) activities conducted on the surface of lands in connection with a surface coal mine or, subject to the requirements of section 40-10-18 of the Act, surface coal mining and reclamation operations and surface impacts incident to an underground coal mine, the products of which enter commerce or the operations of which directly or indirectly affect interstate commerce. Such activities include all activities necessary and incidental to the reclamation of the operations, excavation for the purpose of obtaining coal, including such common methods as contour, strip, auger, mountaintop removal, box cut, open pit, and

area mining; the use of explosives and blasting; in-situ distillation; or retorting, leaching, or other chemical or physical processing; and the cleaning, concentrating, or other processing or preparation of coal. Such activities also include the loading of coal for interstate commerce at or near the mine site. Provided, these activities do not include the extraction of coal incidental to the extraction of other minerals, where coal does not exceed 16-2/3 percent of the tonnage of minerals removed for purposes of commercial use or sale, or coal exploration subject to section 40-10-8 of the Act; and, provided further, that excavation for the purpose of obtaining coal includes extraction of coal from coal refuse piles; and (b) the areas upon which the activities described under part (a) of this definition occur or where such activities disturb the natural land surface. These areas will also include any adjacent land the use of which is incidental to any such activities, all lands affected by the construction of new roads or the improvement or use of existing roads to gain access to the site of those activities and for haulage and excavation, workings, impoundments, dams, ventilation shafts, entryways, refuse banks, dumps, stockpiles, overburden piles, spoil banks, culm banks, tailings, holes or depressions, repair areas, storage areas, processing areas, shipping areas, and other areas upon which are sited structures, facilities, or other property or material on the surface, resulting from or incident to those activities.

"Cumulative Impact Area" means the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface and groundwater systems. Anticipated mining will include, at a minimum, the entire projected lives through bond releases of: (a) the proposed operation, (b) all existing operations, (c) any operation for which a permit application has been submitted to the Division, and (d) all operations required to meet diligent development requirements for leased federal coal for which there is actual mine development information available.

"Ephemeral Stream" means a stream which flows only in direct response to precipitation in the immediate watershed, or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table.

"Ground Water" means subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

"Hydrologic Balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage.

"Hydrologic Regime" means the entire state of water movement in a given area. It is a function of the climate and includes the phenomena by which water first occurs as atmospheric water vapor, passes into a liquid or solid form, falls as precipitation, moves along or into the ground surface and returns to the atmosphere as vapor by means of evaporation and transpiration.

"Intermittent Stream" means (a) a stream, or reach of a stream, that drains a watershed of at least one square mile, or (b) a stream, or reach of a stream, that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge.

"Perennial Stream" means a stream or part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff. The term does not include intermittent stream or ephemeral stream.

"Permit Area" means the area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under R645-301-800, and which will include the area of land upon which the operator proposes to conduct coal mining and reclamation operations under the permit, including all disturbed areas, provided that areas adequately bonded under another valid permit may be excluded from the permit area.

"Quarterly sampling" means collecting representative water samples from all designated water monitoring locations at least once per three month period with a minimum of one month between sampling events.

4. Policy

A. By Memorandum of Understanding (MOU) dated October 16, 1990, between the Division of Oil, Gas and Mining (DOGM) and the Utah Department of Health, Division of Environmental Health, (DEH) covering permitting of mining operations in Utah, DOGM acknowledges that the Utah Water Pollution Committee is the UPDES and UIC permitting authority as delegated by the Environmental Protection Agency (EPA). By letter dated September 30, 1991, in recognition of the newly established Utah Department of Environmental Quality (DEQ) Brent Bradford, Deputy Director, DEQ, assigned this October 16, 1992 MOU to the DEQ. All permitting actions for a UPDES permit shall be referred by the Division to the DEQ.

The Division of Water Quality at the DEQ administers the Nonpoint Source Program. Regulations under this program focus on storm water runoff and management. Construction and development activities are governed by these regulations.

B. Water monitoring should be designed to provide information to determine the probable hydrologic consequences of all mining and reclamation activities to the quantity and quality of surface and groundwater under seasonal variation for the permit area and adjacent areas. Water monitoring programs can be divided into three phases, baseline, operational and post mining.

Baseline monitoring is intended to provide pre-mining water quality and quantity conditions. This baseline information should be used in the development of the Probable Hydrologic Consequences (PHC) document.

Operational water monitoring data should be utilized to demonstrate the validity of the PHC. The data should aid in determining the status of any mining related impacts to the hydrologic balance.

The post mining monitoring continues until bond release to provide information relevant to potential impacts due to the mining and reclamation activity. It should also verify for bond release that the water quality from a reclaimed site

is meeting all State and Federal water quality requirements.

C. Monitoring programs should include surface water, springs, underground sources and wells. Table 1: Surface Water Sampling and Table 2: Ground Water Sampling provide specific sampling requirements for various water sources. These tables are included in Appendix A and are incorporated herein by reference.

D. Sampling and analysis should be adequate to demonstrate compliance with all state and federal water quality protection regulations and to ensure that the postmining beneficial uses of the water are maintained.

E. Laboratory analysis of water samples will be conducted in accordance with Table 3: Surface Water Baseline, Operational and Postmining Water Quality Parameter List and Table 4: Ground Water Baseline, Operational and Postmining Water Quality Parameter List which are attached in Appendix A and are incorporated herein by reference.

F. Appropriate Quality Assurance/Quality Control (QA/QC) must be incorporated into all water monitoring programs for sampling, sample handling and storage and during analytical procedures as required by R645-301-723.

G. Amendments to water monitoring programs are allowed as specified under the R645 rules for permit amendments and more particularly for water monitoring as specified in the Procedures section below.

5. Procedure

A. General Water Monitoring Information

All coal mining operations are required to develop surface and groundwater monitoring programs as part of their mining and reclamation plan. These plans must provide for collection of the following water related information, which will be used to determine the use and objectives for protection.

1. Provide mapped location of all water sources.
2. Provide adequate information to assess the quality and quantity under seasonal variation.
3. Provide geologic origin and rates of discharge for each source.
4. Provide ownership information, seasonal use and quantity of use for each source.

The plan will provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance set forth in R645-301-731. It will identify the quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance as required by R645-301-728. Water monitoring will continue through mining and continue during reclamation until bond release.

Table 3: Surface Water Baseline, Operational and Postmining Water Quality Parameter List and Table 4: Ground Water Baseline, Operational and Postmining Water Quality Parameter List provide the parameter lists required for baseline, operational and postmining water quality studies. Water monitoring is required for each site on a quarterly basis.

B. Baseline Monitoring

Prior to permit issuance adequate baseline information must be collected to satisfy the requirements of R645-301-724.100 and 724.200. Tables 3 and 4 list the parameters required in baseline studies. Baseline information will be collected quarterly for a minimum of two years prior to permit issuance. Data should be sufficient to demonstrate seasonal variation in quality and quantity for each source.

C. Operational Monitoring

Ground-Water

Water monitoring plans will be based upon the PHC determination required under R645-301-728. The plan will provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance set forth in R645-301-731. Table 4 lists the required parameters for operational monitoring of ground water sources unless the Division has approved an amendment to the monitoring program.

Surface-Water

Water monitoring plans will be based upon the PHC determination required under R645-301-728. The plan will provide for the monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance as set forth in R645-301-731 as well as the effluent limitations found in R645-301-751;

For point-source discharges, monitoring will be conducted in accordance with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for Utah Pollutant Discharge Elimination System (UPDES) permits;

Table 3 provides the required parameters for operational monitoring of surface water sources unless the Division has approved an amendment to the monitoring program..

D. Post-Mining Monitoring

Water monitoring will continue through the life of the mine, and reclamation until bond release. Tables 3 and 4 include the parameters required for postmining monitoring. Water monitoring information will be used to determine that all State and Federal water quality laws are being met and that the reclaimed areas are not contributing additional contributions of Suspended Solids to stream flow outside the permit area. The Division may be formulating a bond release directive which would include the water monitoring requirements for bond release.

E. Amendments to Water Monitoring

Programs

Amendments to water monitoring programs may be submitted by the permittee and will be approved according to the Division's permit amendment process and as specifically outlined for water monitoring below.

Amendments to monitoring programs will be approved on a site specific basis. Quarterly sampling is required at each surface and ground water monitoring location. R645-301-731.200 and Tables 3 and 4 in Appendix A specify the minimum parameters to be analyzed for. The required monitoring may be reduced to field parameters and the parameters identified in R645-301-731.200 on a quarterly basis plus one complete operational sample collected during the low flow (August or September) season if the following criteria are met. Inaccessibility will not be considered an excuse to forego the annual operational sample.

1. Sites above and below a mine's disturbed area and discharge points, public drinking water sources, and other high priority sources must be monitored quarterly in accordance with Tables 1 through 4 in Appendix A.

2. Monitoring requirements for sites not included in the above group may be amended to reduce the parameters based on the following criteria:

- a. If the water source is included in a water right, then the surface landowner or water right holder must be notified of the proposed change and be given an opportunity to respond.
- b. Appropriate historical quality data has been collected to show that a good cation/anion balance exists with these data.
- c. Historical data can be used in a regression analysis to demonstrate that conductivity correlates to the specific water quality of that site. A good description of this type of analysis is given on pages 66-69 of Study and Interpretation of the

Chemical Characteristics of Natural Water, 3rd edition, USGS Water Supply Paper 2254, 1992.

- d. The site is not critical to the ongoing PHC determination.
- e. Criteria identified in R645-301-731.214 and 731.224.
- f. Subsidence monitoring information may be used to indicate that further subsidence is not likely and that future mining will not occur in adjacent areas which could affect this water source.

The Division may require additional monitoring in accordance with R645-301-724.500, R645-301-731, as required by Division Orders or to address citizens complaints.

F. The Division will create a hydrologic work group consisting of three Division technical staff members involved in hydrology permitting and inspection to review amendments to water monitoring programs submitted by a permittee. The review group will review the proposed changes on a site specific basis. Current and post-mining water use, potential impacts from the mining operation, and other factors will be considered in the review process.

6. Delegated Responsibilities

- A. Initiation of amendments to water monitoring programs: Coal Mine Permittee
- B. Review water monitoring program amendments: Division Hydrologic Work Group

7. Reporting Requirements

In accordance with R645-301-130, R645-301-731.212 and 731.223, analytical results of all samples collected for each monitoring location will be submitted to the Division at least every three

months.

TECH-004.DIR

8. References

United States Geological Survey, Study and Interpretation of the Chemical Characteristics of Natural Waters, Water Supply Paper 2254, 1992.

9. Effect on Other Documents

Supersedes Monitoring Programs for Coal Mines directive dated May 6, 1996.

10. Division Contact/Work Group

Ken Wyatt, Jim Smith, Sharon Falvey,
Dave Darby, Steve Johnson

11. Key Words

Water Quality, Water Monitoring,
Parameters, Amendments

12. Appendices

Appendix A:

Table 1: Surface Water Sampling

Table 2: Ground Water Sampling

Table 3: Surface Water Baseline, Operational and
Postmining Water Quality Parameter List

Table 4: Ground Water Baseline, Operational and
Postmining Water Quality Parameter List

APPENDIX A

Table 1: Surface Water Sampling

	Baseline	Operational	Postmining
Type of Sampling site	Surface Water Bodies in the permit and adjacent area: Streams and tributaries; Stockwatering ponds; Impoundments; Discharge points (UPDES, other).	Surface Water Bodies: Those baseline and operational stations determined necessary for operational phase monitoring.	Surface Water Bodies: Those baseline, operational and reclamation stations determined necessary to meet bond release criteria.
Field Measurements and data collected	Performed during water level/flow measurements. According to Table 3	Performed during water level/flow measurements. According to PAP and Table 3	Performed during water level/flow measurements. According to PAP and Table 3
Sample Frequency	<p><u>Quarterly</u> for lakes, reservoirs and impoundments</p> <p><u>Monthly</u> flow measurements for perennial streams</p> <p><u>Quarterly</u> water quality measurements for perennial streams, with one sample at low flow and one at high flow.</p> <p><u>Monthly</u> water quality and flow measurements during period of flow for intermittent streams.</p> <p>Water quality and flow measurements schedules will be based on proximity to downstream water uses and potential for impacts.</p>	<p><u>Quarterly</u> for water quality lakes, reservoirs and impoundments (water level and quality)</p> <p><u>Quarterly</u> water quality and flow measurements for perennial streams, with one sample at low flow and one at high flow.</p> <p><u>Quarterly</u> water quality flow measurements during period of flow for intermittent streams, with a minimum of one water quality and flow measurement during period of flow.</p> <p>Water quality and flow measurements schedules will be based on proximity to downstream water uses and potential for impacts.</p>	<p>Quarterly for perennial streams (high & low flow);</p> <p><u>Two</u> water quality and flow measurements <u>per annum</u> during snowmelt and rainfall for intermittent streams.</p> <p>Water quality and flow measurements schedules will be based on the requirements for bond release.</p>
Sampling Duration	<u>Two</u> years (one complete year of data before submission of PAP. Adequate to describe seasonal variation.	<u>Every</u> year until two years after surface reclamation activities have ceased.	<u>Every</u> year until termination of bonding

	Baseline	Operational	Postmining
Reporting requirements	<p><u>Quarterly</u> reports include:</p> <ul style="list-style-type: none"> Copies of DMR's Lab reports with: Results of analysis Method of analysis Date of analysis Date sampled Date sample received Precipitation data where applicable. 	<p><u>Quarterly</u> reports same as baseline.</p> <p>Annually report as required by the Division.</p>	<p><u>Quarterly</u> reports same as baseline.</p> <p>Prior to Bond release -adequate to assist the Division in determining</p> <p><u>Phase I:</u> Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement.</p> <p><u>Phase II:</u> After revegetation has been established and contributing suspended solids to streamflow or runoff outside the permit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751.</p> <p><u>Phase III:</u> Until reclamation requirements of the Act and the permit are fully met.</p>
Comments	All field measurements performed concurrently with level/flow measurements. Stations used as comparative tools for PHC should be monitored on the same days.	All field measurements should be performed concurrently with level/flow measurements. Every fifth year (midterm), one sample at low flow or one at high flow. Each should be taken for baseline water quality parameters. An additional construction monitoring program may be required	

Table 2: Ground Water Sampling

	Baseline Monitoring	Operational Monitoring	Postmining Monitoring
Type of Sampling site	Springs, In-Mine Flows, Boreholes, Observation Wells.	Spring, In-Mine Flows, Boreholes, Observation Wells.	Springs, Observation Wells, Mine discharge points.
Field Measurements and Parameters (see Table 4)	Water levels and/or flow and water quality.	Water levels and/or flow and water quality.	Water levels and/or flow and water quality.
Sample Frequency Each site	<u>Quarterly</u> Adequate to describe seasonal variation. <u>Monthly</u> recommended for more accurate description of seasonal variation.	<u>Quarterly</u> samples springs and wells; In-mine flows <u>at initial interception, quarterly after 1st 30 days until diminished.</u> From sumps and/or mine discharge points <u>quarterly or as required by UPDES.</u>	<u>Quarterly</u> based on potential impact; or <u>once per annum</u> (spring sampling at low flow).
Sampling Duration	<u>Two</u> years (one complete year of data before submission of PAP).	<u>Every</u> year until two years after surface reclamation activities have ceased.	Until termination of bonding.
Type of Data Collected and Reported	Wells and Boreholes- Water quality, water level or flow logs, collar elevation; ground elevations; screened interval; formation where completed; depth. Springs: Water quality, location, and flow.	Wells and boreholes: Water quality, water level or flow. Springs: Flow and water quality with one sample taken at low flow.	Wells and boreholes: Water quality, water level or flow. Springs: Flow, water quality with one sample taken at low flow. <u>Phase I:</u> Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement. <u>Phase II:</u> After revegetation has been established and contributing suspended solids to streamflow or runoff outside the permit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751. <u>Phase III:</u> Until reclamation requirements of the Act and the permit are fully met.
Comments	Springs and seeps should be measured from source at high and low flow periods.	During the year preceding re-permitting. Springs, one water quality sample at low flow for baseline parameters. Other sites, one sample for baseline parameter.	

TABLE 3

Utah Division of Oil, Gas & Mining
Surface Water Monitoring Requirements
Baseline, Operational and Post-mining

<u>FIELD MEASUREMENTS</u>			<u>REPORTED AS</u>
*	-	Water level or Flow	Depth, Flow
*	-	pH	Standard units
*	-	Specific Conductivity	umhos/cm @ 25° C
*	-	Dissolved Oxygen	mg/l
*	-	Temperature	°C
 <u>LABORATORY MEASUREMENTS</u>			
*	-	Total Dissolved Solids	mg/l
*	-	Total Settleable Solids	(UPDES)
*	-	Total Suspended Solids	mg/l
*	-	Total Hardness (CaCO ₃)	mg/l
*	-	Total Alkalinity	mg/l
	-	Acidity	mg/l
	-	Aluminum (Dissolved)	mg/l
	-	Arsenic (Dissolved)	mg/l
	-	Boron (Dissolved) ¹	mg/l
*	-	Carbonate	mg/l
*	-	Bicarbonate	mg/l
	-	Cadmium (Dissolved)	mg/l
*	-	Calcium (Dissolved)	mg/l
*	-	Chloride	mg/l
	-	Copper (Dissolved)	mg/l
*	-	Iron (Dissolved)	mg/l
*	-	Iron (Total)	mg/l
	-	Lead (Dissolved)	mg/l
*	-	Magnesium (Dissolved)	mg/l
*	-	Manganese (Dissolved)	mg/l
*	-	Manganese (Total)	mg/l
	-	Molybdenum (Dissolved)	mg/l
	-	Ammonia	mg/l
	-	Nitrates	mg/l
	-	Nitrites	mg/l
*	-	Potassium (Dissolved)	mg/l
	-	Phosphates(Ortho)	mg/l
	-	Selenium ¹ (Dissolved)	mg/l
*	-	Sodium (Dissolved)	mg/l
*	-	Sulfate	mg/l
	-	Zinc (Dissolved)	mg/l
*	-	Oil & Grease ²	mg/l
*	-	Cations	meq/l
*	-	Anions	meq/l

¹ Parameters will be analyzed for baseline at all sites and included as operational at waste rock sites.
² O&G to be collected above and below mine sites.
- Parameters required for Baseline monitoring.
* Parameters required for Operational and Post-mining monitoring unless amended as per section 5E above.

TABLE 4

Utah Division of Oil, Gas & Mining
Ground Water Monitoring Requirements
Baseline, Operational and Post-mining

<u>FIELD MEASUREMENTS</u>			<u>REPORTED AS</u>
*	-	Water level or Flow	Depth, Flow
*	-	pH	Standard units
*	-	Specific Conductivity	umhos/cm @ 25° C
*	-	Temperature	°C
<u>LABORATORY MEASUREMENTS</u>			
*	-	Total Dissolved Solids	mg/l
*	-	Total Hardness (CaCO ₃)	mg/l
*	-	Total Alkalinity	mg/l
	-	Acidity	mg/l
	-	Aluminum (Dissolved)	mg/l
	-	Arsenic (Dissolved)	mg/l
	-	Boron (Dissolved) ¹	mg/l
*	-	Carbonate	mg/l
*	-	Bicarbonate	mg/l
	-	Cadmium (Dissolved)	mg/l
*	-	Calcium (Dissolved)	mg/l
*	-	Chloride	mg/l
	-	Copper (Dissolved)	mg/l
*	-	Iron (Dissolved)	mg/l
*	-	Iron (Total)	mg/l
	-	Lead (Dissolved)	mg/l
*	-	Magnesium (Dissolved)	mg/l
*	-	Manganese (Dissolved)	mg/l
*	-	Manganese (Total)	mg/l
	-	Molybdenum (Dissolved)	mg/l
	-	Ammonia	mg/l
	-	Nitrates	mg/l
	-	Nitrites	mg/l
*	-	Potassium (Dissolved)	mg/l
	-	Phosphate (Ortho)	mg/l
	-	Selenium ¹ (Dissolved)	mg/l
*	-	Sodium (Dissolved)	mg/l
*	-	Sulfate	mg/l
	-	Zinc (Dissolved)	mg/l
*	-	Cations	meq/l
*	-	Anions	meq/l

¹ These parameters will be analyzed in the baseline for all sites and included as operational at waste rock sites only.
- Indicates parameters required for Baseline monitoring.
* Indicates parameters required for Operational and Post-mining monitoring unless amended as per section 5E above.